Deutscher Wetterdienst

Meteorological Service of Canada
Service météorologique du Canada

AutoWARN

The Automated Weather Warning System in NinJo

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Content

- Introduction and Overview
- Automatic Warning Process
- Radar Products
- Statistical Products and COSMO-DE Interpretation

AutoWARN Project Goals

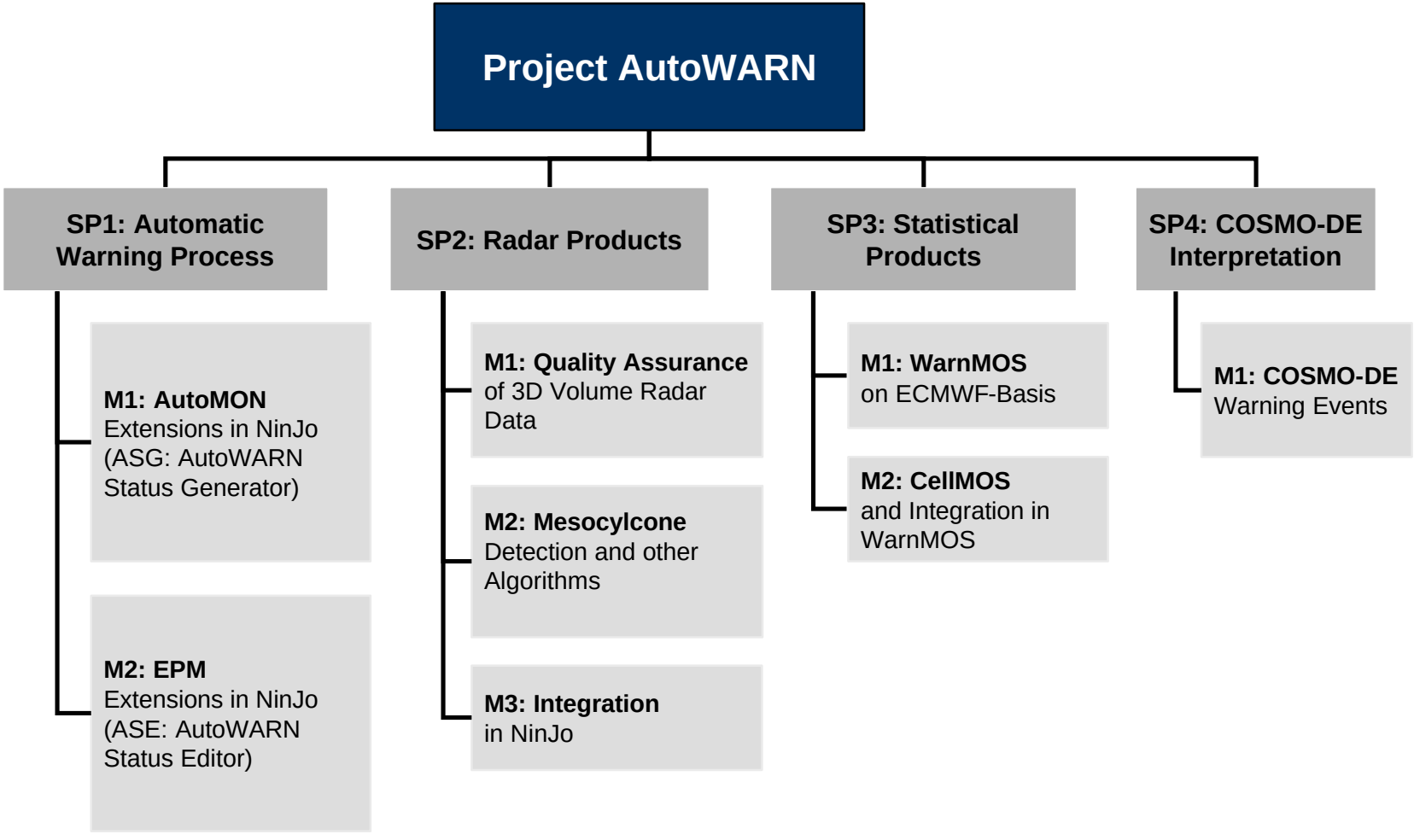
AutoWARN is part of the DWD strategy 2006-2015 (Headwords: *Centralization* and *Automation*).

Project goals:

1. **Improvement of methods and products serving as a basis for the prediction of hazardous weather events**

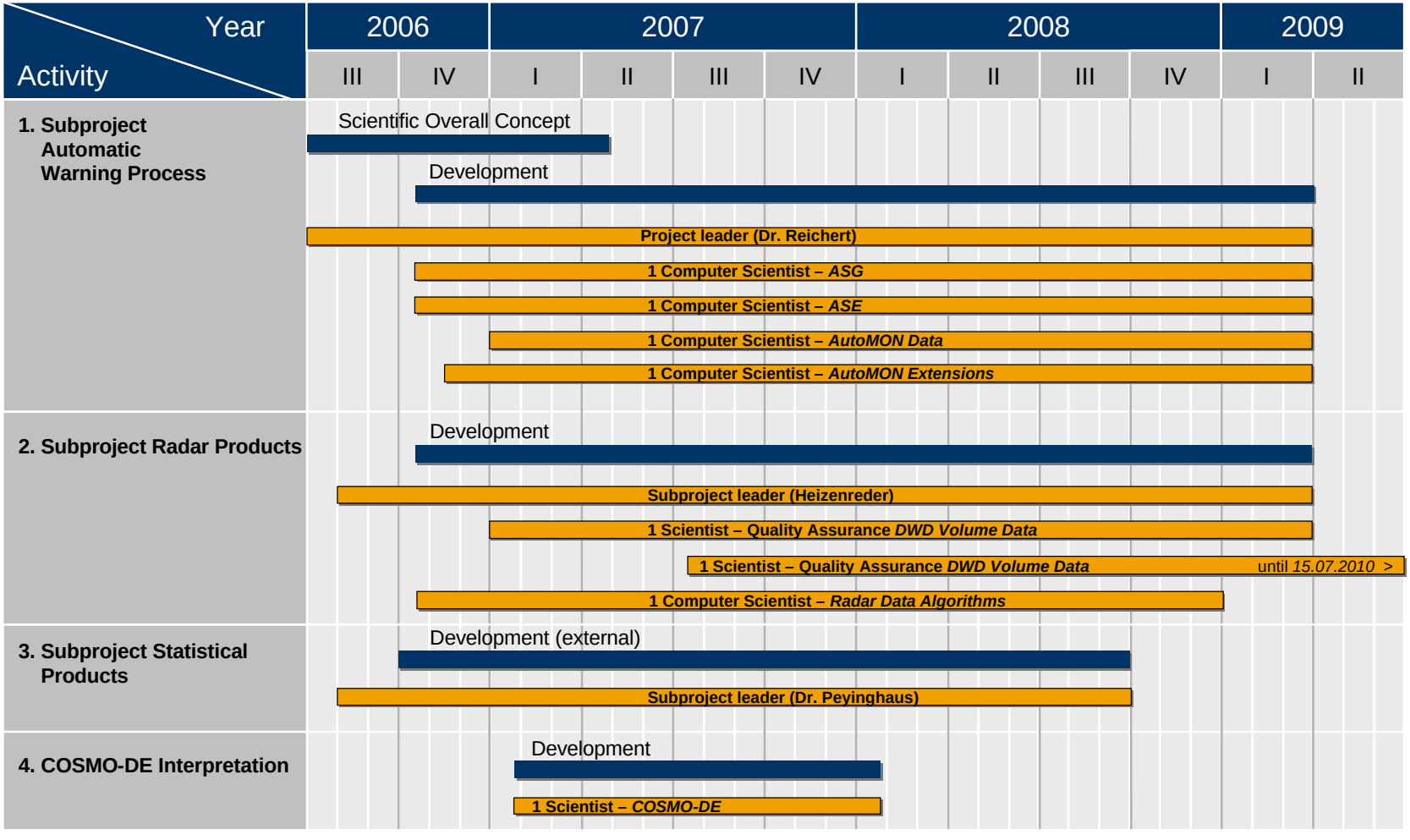
2. **Integration of products in an automated warning process with manual monitoring and decision capabilities by the forecaster**

Project Structure



Project AutoWARN

Time Planning Resources



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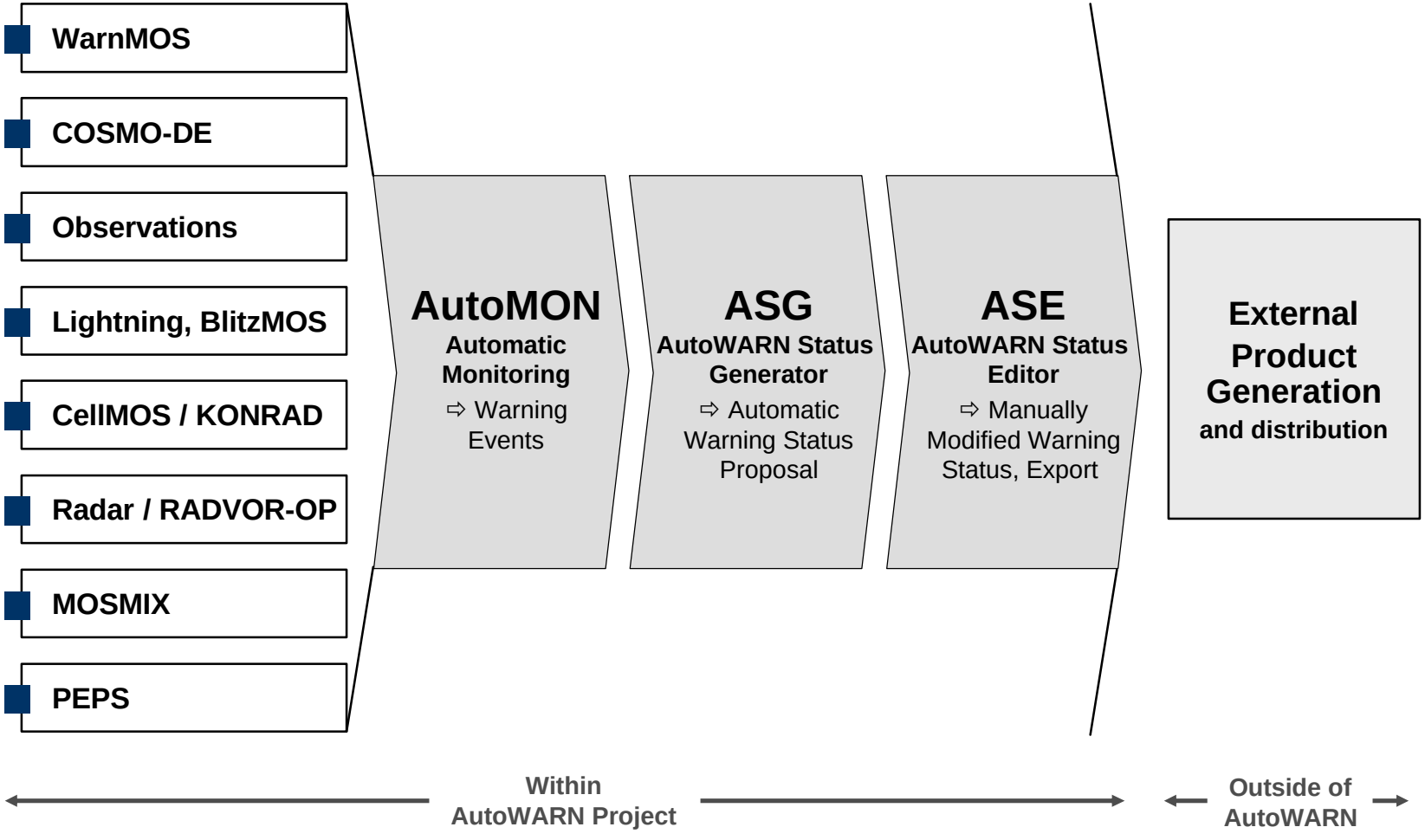
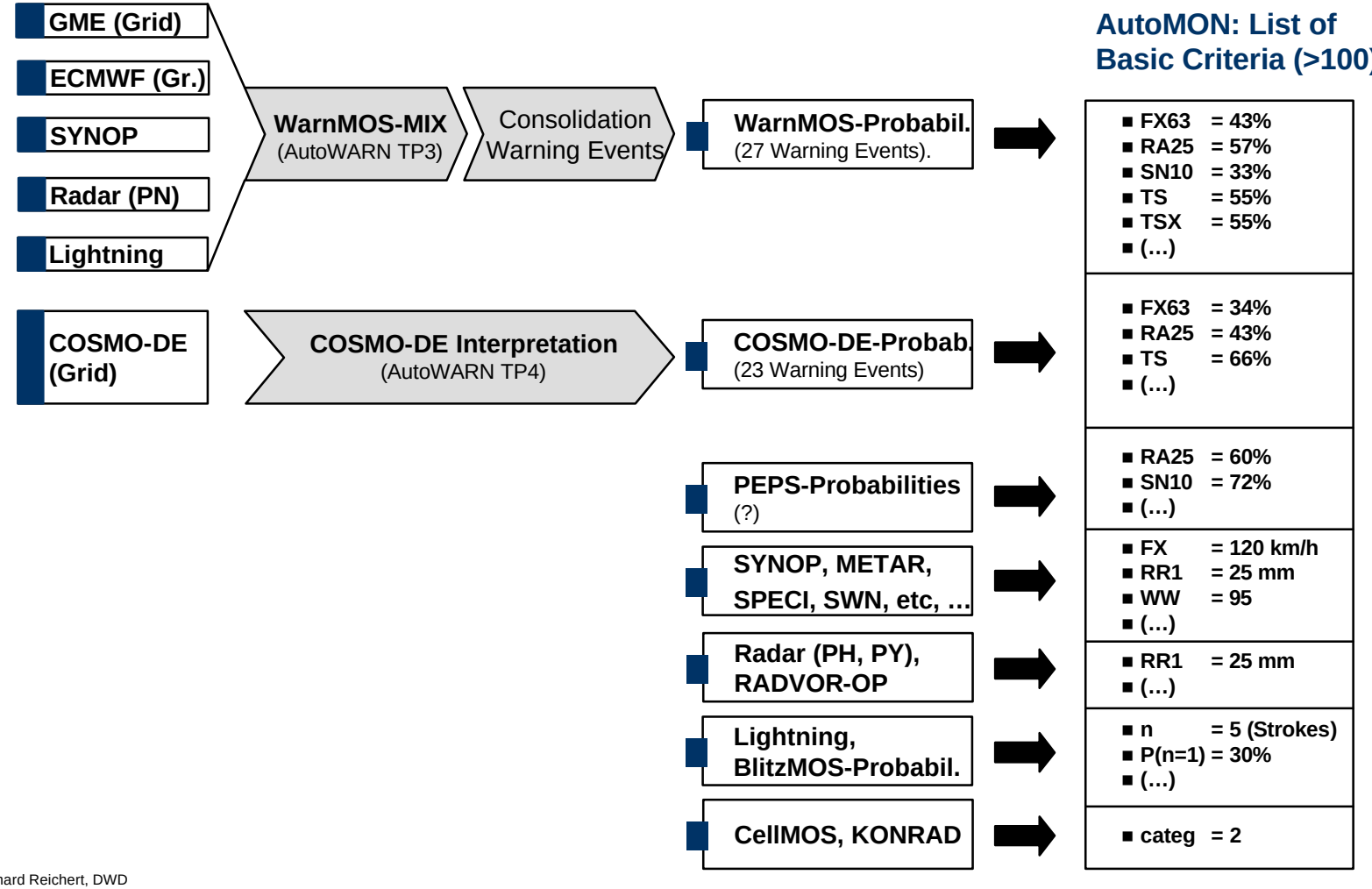
Automatic Warning Process: Goals

- **Exploitation and combination of various data sources**
  - Arbitrary data combinations (Probability information (WarnMOS), Nowcasting, Observations, Model runs, etc.)
  - Definition and monitoring of threshold values
- **Generation of a forecast-time dependant automatic warning status**
  - Ensures that required warnings cannot be overlooked
  - Supports the warning service
- **Permanent updates of the warning status**
- **Permanent manual control by the forecaster**
  - manual modification if necessary
- **Export of generated warning status to external system (outside of project AutoWARN)**
  - External generation of text and graphical products considering client demands

Automatic Warning Process: Overview



Generation of a Warning Status Proposal 1/3



Generation of a Warning Status Proposal 2/3

AutoMON: List of Basic Criteria (>100)

- FX63 = 43%
- RA25 = 57%
- SN10 = 33%
- TS = 55%
- TSX = 55%
- (…)

- FX63 = 34%
- RA25 = 43%
- TS = 66%
- (…)

- RA25 = 60%
- SN10 = 72%
- (…)

- FX = 120 km/h
- RR1 = 25 mm
- WW = 95
- (…)

- RR1 = 25 mm
- (…)

- n = 5 (Strokes)
- P(n=1) = 30%
- (…)

- categ = 2

AutoMON: Spatiotemp. Combination

OR

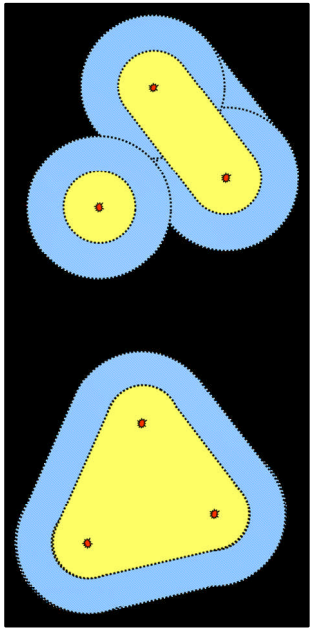
OR

AND

AutoMON: Combined Warning Criteria

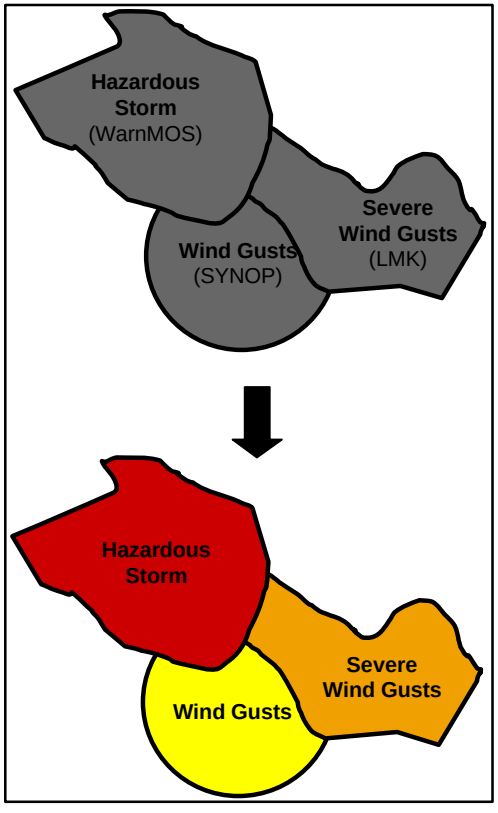
- Wind Gusts
- Hazardous Storm
- Heavy Rain
- Continuous Heavy Rain
- Thunderstorm with Heavy rain and Hail
- (…)

ASG: Spatiotemporal Homogenization

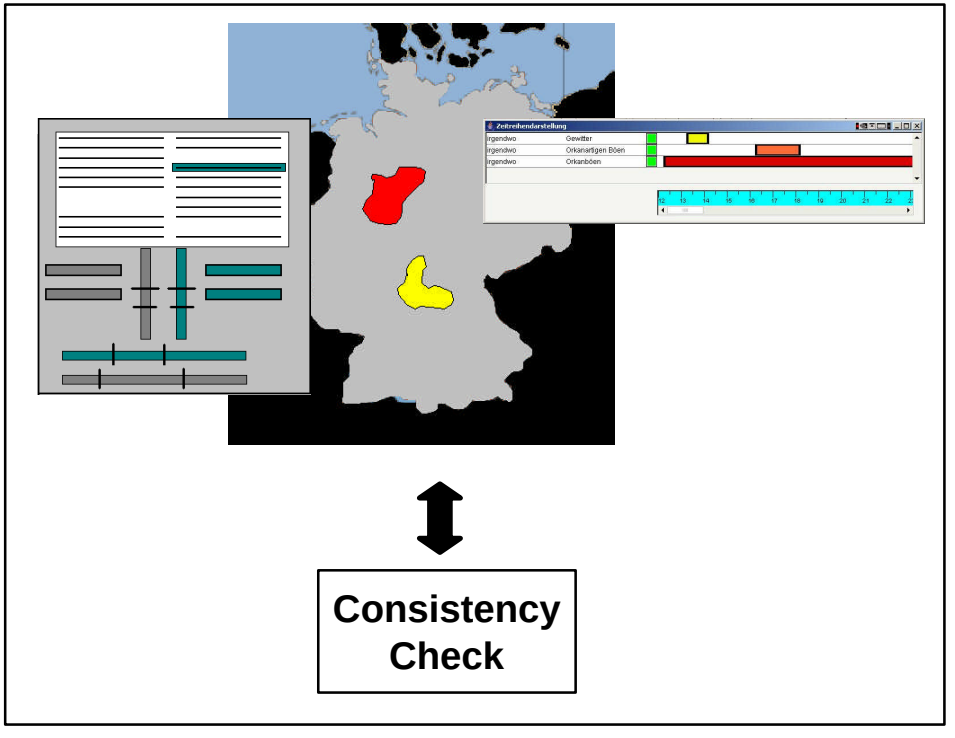


Generation of a Warning Status Proposal 3/3

ASG:
Force Consistency



ASE: Manual Modification of Warning Status Units with permanent consistency check

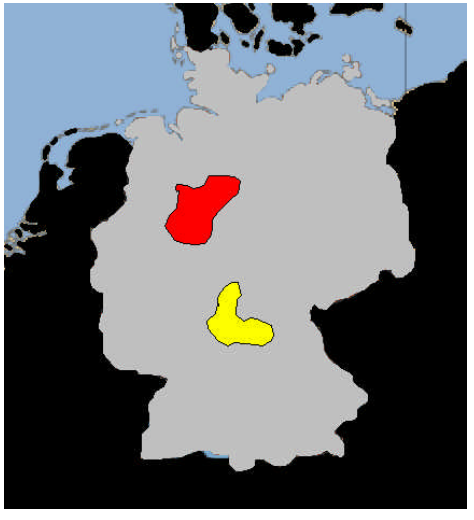


Export Warning Status Proposal to AG PVW

Products of the Semi-Automated Warning Process in AutoWARN

- **AutoWARN generates**
  - **categorical warn status data (will be extended to probabilities in a project starting in 2009)**
    - **For 27 DWD warning events plus approx. 20 combined warning criteria**
    - **on a polygon basis (“warning status units” in space and time)**
    - **vertical categorization to the DWD altitudes (e.g. 0-200m, 400-1000m, 1000-2500m)**
    - **hourly forecasted 0…72 hours**

AutoWARN warning status
(all warning criteria, 0...72 hours)



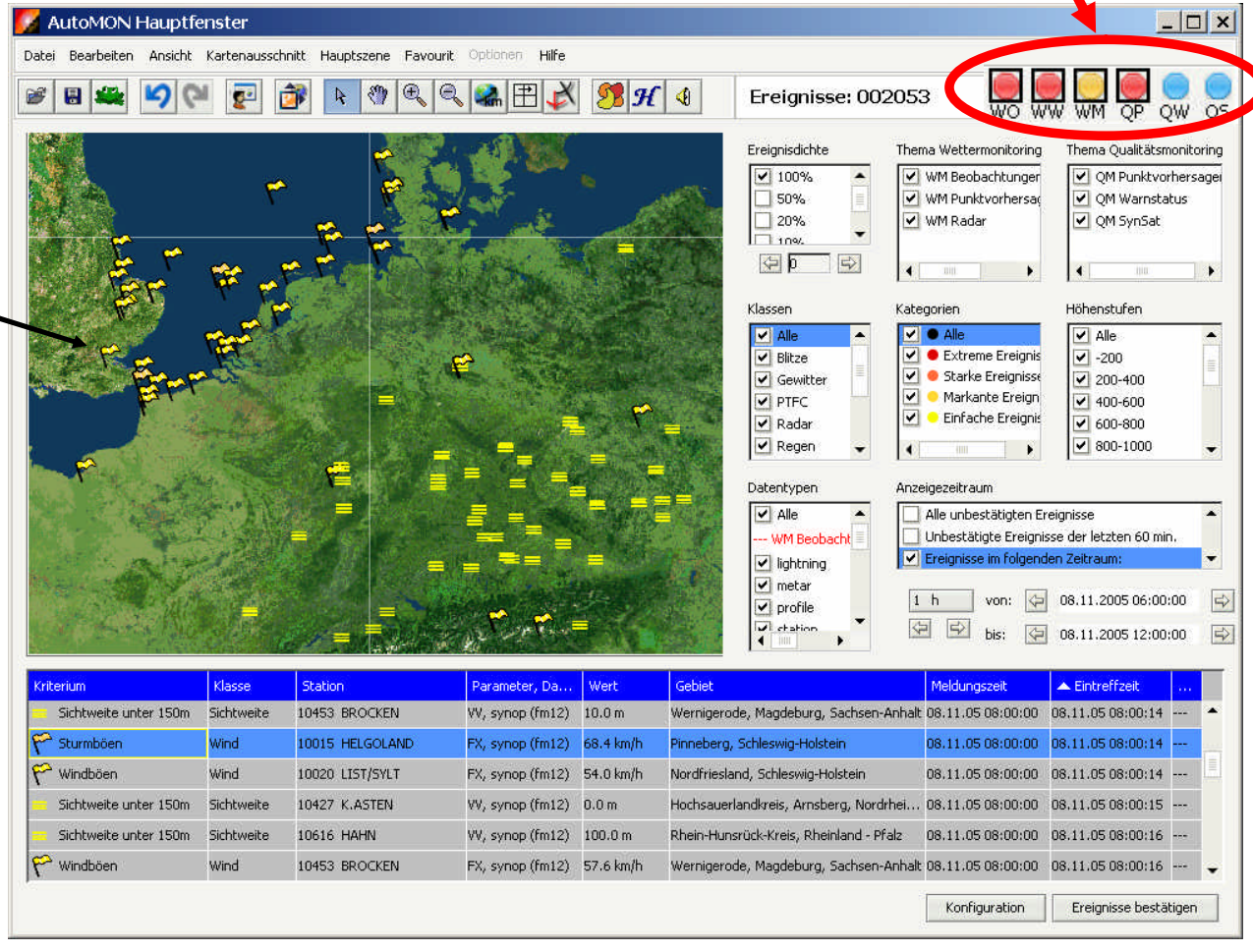
What AutoWARN not does

- **AutoWARN does not generate direct warning products for clients**
  - **AutoWARN only generates automatic warning status proposals revised by the forecaster, only the following external module (PVW) generates warning products**
- **AutoWARN cannot create “perfect” warning status proposals for all warning events automatically**
  - **an automatic warning status proposal cannot be better than the input products (WarnMOS, COSMO-DE model, etc.)**
  - **some warning events like fog or locally clear ice need the intervention of the forecaster, who is part of the AutoWARN concept**

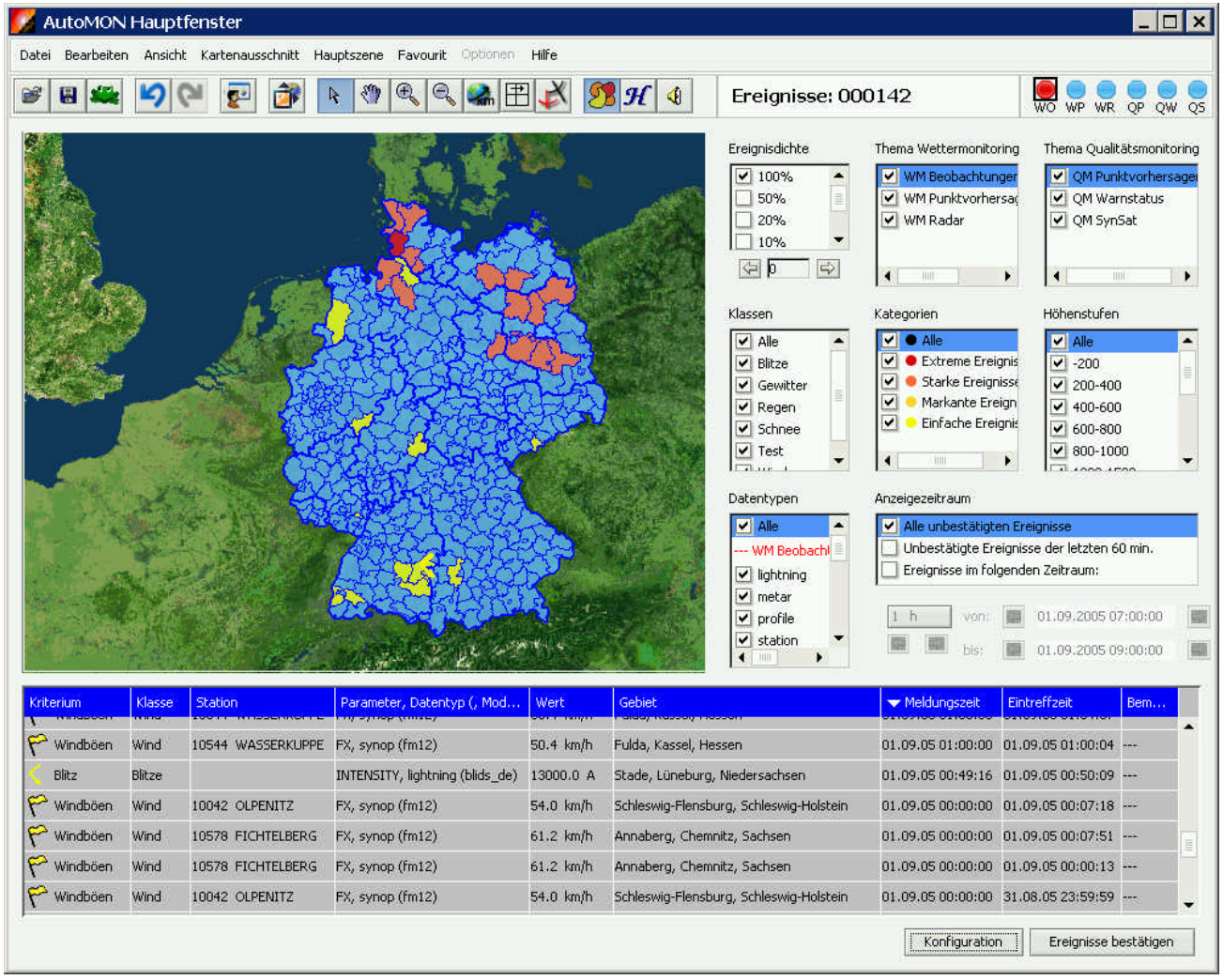
Automatic Warning Process: Component AutoMON in NinJo

Warning Indicators
showing status since last confirmation

Warning Events



Automatic Warning Process: Component AutoMON in NinJo



Automatic Warning Process: AutoMON Extensions

AutoMON Extensions

- **Include far more input data (areal probabilities from WarnMOS and COSMO-DE model, other probabilistic products, Grid-Data, more Radar-Data, more nowcasting products)**
- **Allow forecast-time dependant configuration of probability data for the generation of warning categories**
- **Allow full spatio-temporal combination of data for warning events**
- **Improve stability and reliability of AutoMON for AutoWARN**

AutoWARN Status Editor (ASE)

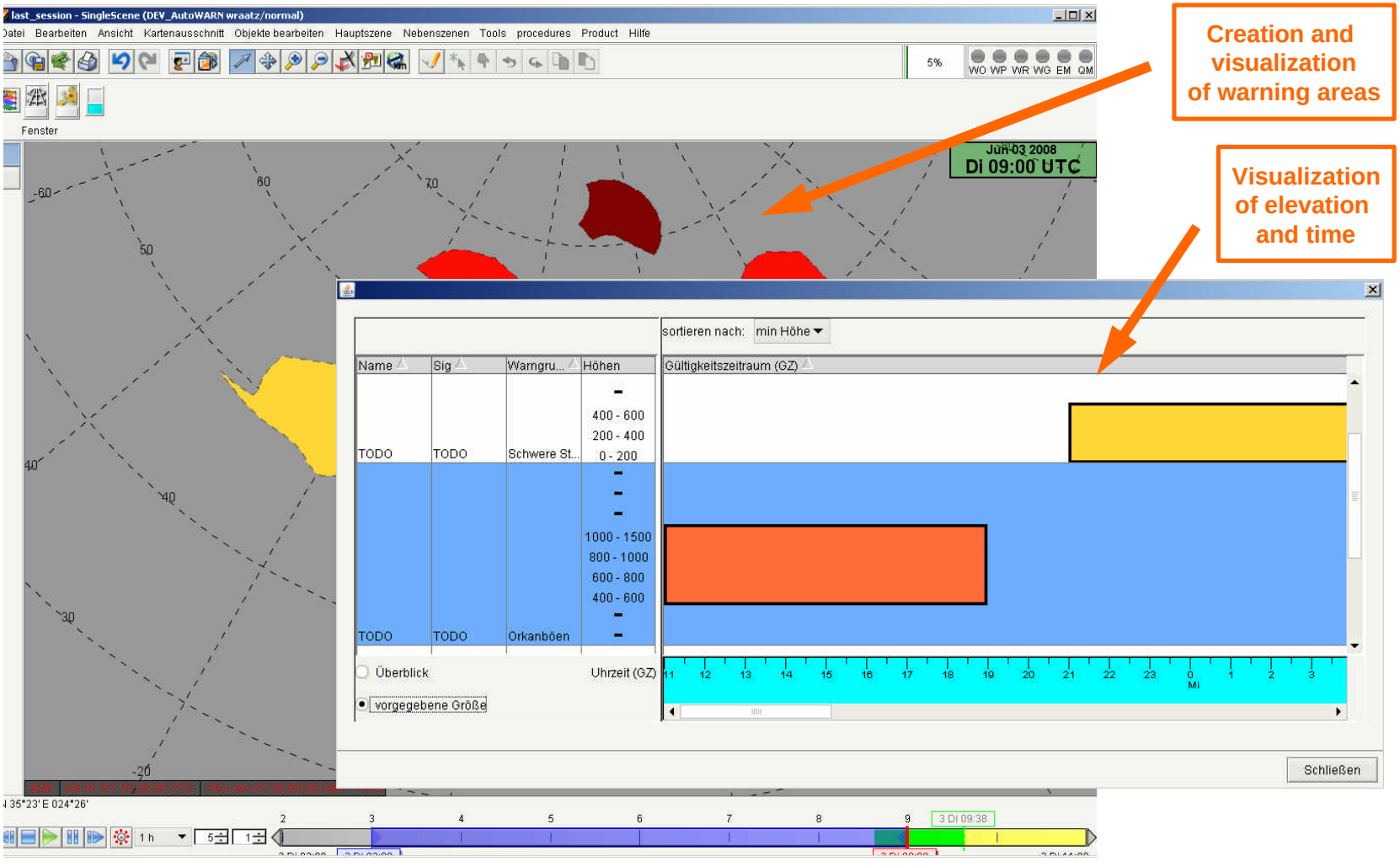
Requirements

- Presentation of warning status proposals by ASG (AutoMON Status Generator)
- Editing the future warning status based on warning status proposals

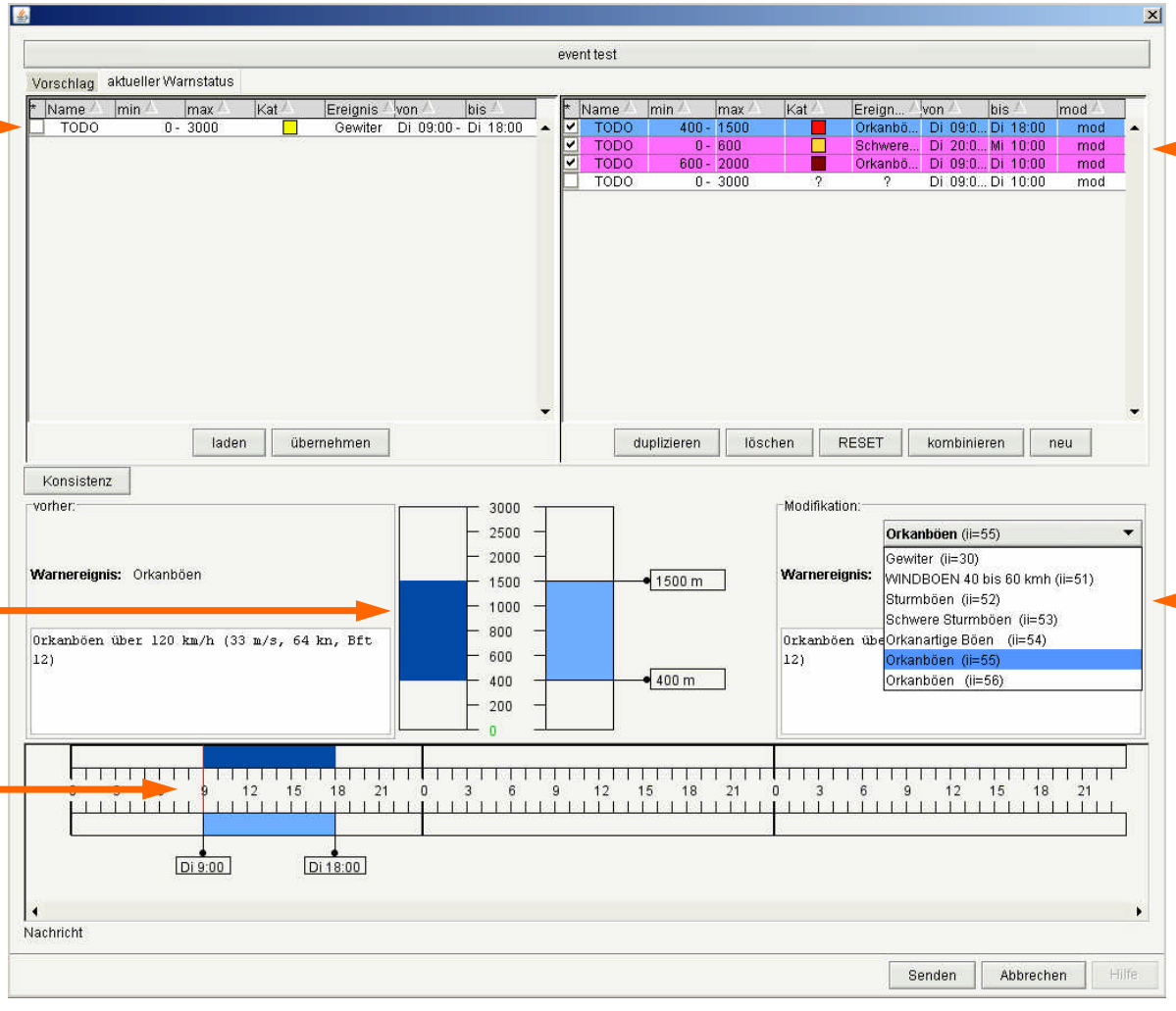
Result

- New warning status for subsequent generation of warning products and verification outside of AutoWARN

AutoWARN Status Editor (ASE) - GUI Creation and Visualization of Warning Status



AutoWARN Status Editor (ASE): GUI Warning Status Properties



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Radar Products: Goals

- **Exploitation of DWD Doppler data, Quality Assurance of 3D-Volume Scans**

- **Implementation of Mesocylcone Detection and other Radar Algorithms**
  - **Improved algorithms for mesocyclone-, gust- and downburst-detection**
  - **Tornado-Identification algorithms**
  - **Exploitation of Doppler data**
  - **Benefit from Canadian Radar know-how**

- **Visualization in NinJo**

- **Integration of New Products in NinJo and Automatic Warning Process**

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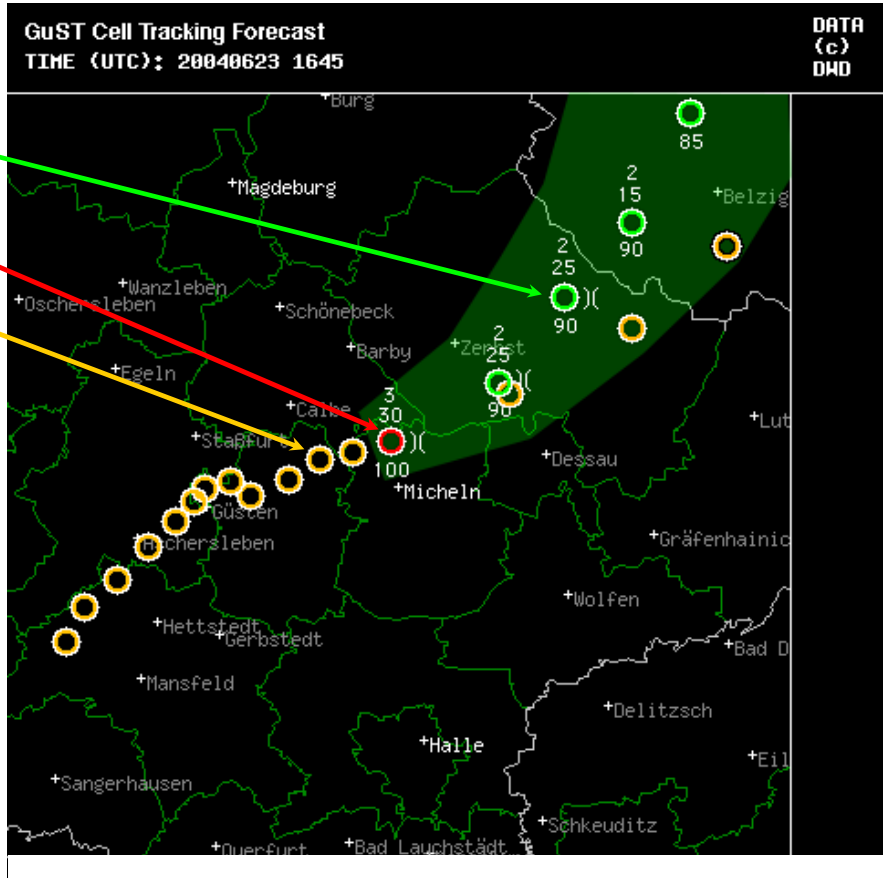
Statistische Produkte und COSMO-DE Interpretation: Ziele

- **Extension of WarnMOS (Areal Probability Data for Warning Events)**
  - **Implementation of WarnMOS-MIX using GME und ECMWF-Model**
- **Implementation of a new Storm Cell Tracking System CellMOS**
  - **Using GME-Model, Radar Composite, Radar-Analysis (KONRAD), Lightning Data**
  - **Cell Analysis using Radar Data (KONRAD) and optimized statistical tracking approach (MOS-System)**
- **COSMO-DE Interpretation**
  - **Generation of Probability Data for 23 Warning Events from High Resolution Limited-Area Model COSMO-DE (2.8 km resolution)**
- **Integration of New Products in NinJo and Automatic Warning Process**

Statistical Products: CellMOS

- **Typical CellMOS-Output**
  - O: Forecasted Cell Track
  - O: Cell at Issue-Time Point(Analysis)
  - O: Observed Cell Track
  - Green Area: Probability > 30% that point in this area is hit by cell



Summary and Outlook

- **Goals of AutoWARN:**

  1. **Improvement of methods and products serving as a basis for the prediction of hazardous weather events**
  2. **Integration of products in an automated warning process with manual monitoring and decision capabilities by the forecaster**

- **Pre-operational test phase for AutoWARN is planned for spring 2009**

- **AutoWARN will in follow-up projects as of 2009 be extended:**

  1. **Optimize system by improving warning parameters and homogenization process**
  2. **Process probability-based information from ensemble model runs, and other MOS-based probability information**